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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/902,728	07/12/2001	Arpan P. Mahorowala	YOR920000789US1	9522

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EXAMINER
BARRECA, NICOLE M

ART UNIT	PAPER NUMBER
1756	

DATE MAILED: 06/03/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/902,728	MAHOROWALA, ARPAN P.	
	Examiner	Art Unit	
	Nicole M. Barreca	1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 May 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-26* is/are pending in the application.

4a) Of the above claim(s) *18,19 and 22-26* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-17,20 and 21* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Pri rity under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

1. Applicant's election of Group I, claims 1-17 and 20-21 in Paper No. 5 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

2. Claims 18, 19, 22-26 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in Paper No. 5.

Specification

3. The abstract of the disclosure is objected to because in line 3 "Hz" should be corrected to $-H_2-$. Correction is required. See MPEP § 608.01(b).

4. The attempt to incorporate subject matter into this application by reference to Attorney Docket Number 0140/00268 (p.7) is improper because the examiner is unable to determine which application number corresponds to the recited Attorney Docket Number. It appears from the subject matter that it may be 09/902,727, which corresponds to Patent Application Publication US 2003/0017711, but the Attorney Docket numbers do not match. Also please see MPEP 608.01 (p) for the guidelines for incorporating essential subject matter in a patent application. It appears to the examiner that this subject matter may be essential since there is no discussion of the process steps used to form the reduced critical dimension bilayer resist image in the present application.

5. The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required: the specification does not disclose that the circuits elements comprise materials selected from the group consisting of dielectric, conductor, semiconductor and doped semiconductor materials, as recited in claim 21.

Claim Objections

6. Claims 3, 5 and 6 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 3 does not further limit claim 1, which previously recited coating an organic underlayer on the substrate and coating a photoresist comprising materials that form a stable, etch-resistant, non-volatile oxide on the underlayer.

7. Claims 5 and 6 are objected to because of the following informalities: as written claims 5 and 6 depend on claim 3. It appears that claims 5 and 6 were intended to further limit (and therefore depend on) the passivating chemistry of claim 3. Appropriate correction is required.

Claim Rejections - 35 USC § 102

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

9. Claims 1, 3-6 are rejected under 35 U.S.C. 102(b) as being anticipated by Ohkuni (EP 903777).

10. Ohkuni disclose a pattern forming method. An organic antireflective coating 12 is deposited on polysilicon underlying film. Resist film 13 is deposited on the organic film. The resist is selectively exposed and developed to form resist pattern 15. The organic layer is then dry etched using the resist pattern as a mask [0072]-[0074]. Embodiment 5 teaches that the organic layer is dry etched with a gas mixture of SO2/O2. S component residues will remain following the etching and the organic layer may react with moisture in the air resulting in a defective pattern if these residues are not removed. Following the pattern etching, a step of removing the S component is performed by treating the structure to a plasma of a gas which has no S components (applicant's chemically-reducing plasma). Examples of gases used in this step include N2, and other gas containing no S component, such as O2, Ar and He [0102]-[0108].

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

12. Claims 2, 9-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohkuni as applied to claim 1 above, and further in view of Allen (US 5985524).

13. Ohkuni is silent on many of the specific details the patterning process, such as on the specific photoresist and organic layer materials and exposure radiations used

and does not disclose that the photoresist material comprises an element selected from Si, P, Ge, Al and B (cl.2), that the photoresist comprises a polymer having acid-cleavable moieties (cl.11), that the photoresist comprises a polymer formed by polymerizing one or more monomers selected from acrylate, methacrylate, hydroxystyrene, cyclic olefin and having silylethoxy acid-cleavable moieties (cl.12), that the photoresist comprises a photoacid generator (cl.13), that the underlayer comprises an organic material of tuned polymers, novolacs and low-k dielectric (cl.9), or of a material comprising carbon, hydrogen and oxygen (cl.10), or that the radiation comprises electromagnetic or e-beam radiation (cl.14), UV or EUV (cl.15) or x-ray radiation (cl.16), or that transferring the image further comprises forming a reduced critical dimension bilayer resist image (cl.17).

Allen discloses a method for forming bilayer resist images for use in the manufacture of integrated circuits. Conventionally the top layer of the bilayer resist contains silicon, boron or germanium which enable the use of oxygen reaction ion etching in the image transfer step. However the incorporation of silicon in the photoresist leads to resolution degradation. This bilayer method improves resolution and critical dimension (col.1, 37-56,cl.17). The top photoresist imaging layer comprises a photoacid generator. The photoresist also may comprise a polymer formed by polymerizing one or more monomers selected from acrylate, methacrylate, hydroxystyrene, cyclic olefin and having silylethoxy acid-cleavable moieties (col.2, 11-65, cl.2, 11-13). The photoresist is coated on an underlying polymer organic layer. Suitable organic polymer underlayers include hard baked novolac, polyimides,

polyesters, and polyacrylates (col.3, 41-48, cl.9-10). The top layer is imagewise exposed to radiation such as UV, EUV, and x-ray (col.4, 13-21, cl.14-16). It would have been obvious to one of ordinary skill in the art to use photoresist material comprising a material selected from Si, P, Ge, Al and B, comprising a polymer formed by polymerizing one or more monomers selected from acrylate, methacrylate, hydroxystyrene, cyclic olefin and having silylethoxy acid-cleavable moieties, and comprising a photoacid generator, to use an underlayer comprising an organic material of tuned polymers, novolacs and low-k dielectric, or of a material comprising carbon, hydrogen and oxygen, and to expose the photoresist using electromagnetic, UV, EUV or x-ray radiation, in the method of Ohkuni because Allen teaches that these photoresist and organic underlayer materials and exposure radiations produce a bilayer resist image with improved resolution.

14. Claims 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohkuni as applied to claim 1 above, and further in view of JP 2000-200832.

15. Ohkuni uses N2, Ar, O2 or He as the chemically reducing plasma treatment gas and does not disclose using hydrogen gas or a hydrogen generating species. JP 2000-200832 teaches examples of reducing plasma gases as H2, N2, NH3 and rare gases (abstract). It would have been obvious to one of ordinary skill in the art to use hydrogen gas or a hydrogen generating gas such as NH3 instead of N2 to treat the etched image in the method of Ohkuni because JP 2000-200832 teaches that H2, N2 and NH3 are all gases which may be suitably used as a reducing gas plasma.

16. Claims 20 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohkuni in view of Allen.

17. The teachings of Ohkuni have been previously discussed. While Ohkuni does teach that the bilayer resist image is used in the manufacture of semiconductor devices, the reference does not explicitly disclose that the image is transferred to the substrate and a circuit image formed or that the circuit element materials comprise materials selected from the group consisting of dielectric, conductor, semiconductor and doped semiconductor materials. Allen teaches that the bilayer resist image may be used to make integrated circuit devices. After the bilayer resist image is formed, circuit patterns can be formed in the substrate followed by the deposition of a conductive, dielectric or doped material (col.4, 56-col.4, 7). It would have been obvious to one of ordinary skill in the art to transfer the resist image to the substrate, and form a circuit element using dielectric, conductor or doped semiconductor materials because Allen teaches that this is how the bilayer resist image is used in the manufacture of an integrated circuit.

Conclusion

18. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. US 2003/0017420 is the Patent Application Publication for the present application. 2003/0017711 discloses a method for trimming a resist pattern.

19. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nicole M. Barreca whose telephone number is 703-308-7968. The examiner can normally be reached on Monday-Thursday (8:00 am-6:30 pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 703-308-2464. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

Nicole Barreca
Patent Examiner
Art Unit 17156

May 30, 2003